ADS-B 1090 MHz Rev A Comments Related to MASPS Changes
RTCA SC-186 WG-3/EUROCAE WG-51 SG-1

#	Comment Author	1090 MOPS Section	Page	Original Comment/Rationale Submitted by Author at June 2000 SC-186 Plenary	Resolution Suggested by Original Comment Author
1	Livack (2)	1.3.5.2 Incursion Monitoring 1.3.6 Other Applications	11 11	Reference the various ADS-B surface movement applications. (See RTCA SC – 193, WG-3 airport mapping user requirements document, Appendix section, and Appendix E, DO-242). Suggest make aircraft "make / model" a REQUIRED information set to be transmitted in addition to other parameters already agreed upon. This information is needed to support various airport surface movement applications, noise monitoring, and to support the GA wake vortex modeling application. Intent would be to display an aircraft's silhouette while on the ground and in-flight and / or support a wake vortex alerting algorithm. Display of aircraft silhouette data on a CDTI with alerting is believed to help reduce display clutter. **WG#3 Position:** *Items 1-4: Can this information be reliably derived?? Will it cause a bandwidth problems??*	This is a safety critical item. The message set needs to be included in the MASPS and MOPS.
2	Livack (3)	1.3.5.2 Incursion Monitoring	11	Reference various future surface movement applications. Suggest make aircraft "heading at Vstop" a REQUIRED information set to be transmitted while operating on the airport surface. Otherwise, there appears to be no means to correlate heading when not in motion. **WG#3 Position:** *See item 1 above.*	This is a safety critical item. The message set needs to be included in the MASPS and MOPS.
3	Livack (4)	1.3.5.2 Incursion Monitoring 3.3.3 Antenna Location	11 633	Reference the various future surface movement applications. Several of these potential applications will require knowing the exact position (within a few feet) of an aircraft with respect to features on an airport surface. Features in this context include runway hold short markings, penalty box depictions (i.e., "holding" locations), gate areas, etc. So, the issue is how do you establish, then communicate the precise location of an antenna as installed on specific make / model aircraft. **WG#3 Position:** *See item 1 above.*	This is a safety critical item. This item needs to be addressed in the MASPS and MOPS. As FYI, it is believed that the SICASP solution (for Mode S) was to provide a Mode S register function that contained the location of up to four antenna positions with respect to the nose of the aircraft. This data was measured from the nose and included height above the ground, to one meter accuracy. The group needs to ensure that this solution (or an equivalent) is included in the current version of the 1090 MOPS.
4	Livack (5)	1.3.5.2 Incursion Monitoring 4.1.1 General Operation	11 653	Future surface movement application. Aircraft brake "on" or "off" position when operating on the airport surface or, alternatively, aircraft percentage power when operating on the airport surface. It is believed that either or both parameters, when integrated into the ADS-B position report, will give significant advance notification / alerting of a pending aircraft movement and thus could be used to provide alerts to a potential runway incursion. **WG#3 Position:** *See item 1 above.*	This may be a safety critical item. The merits of having this message set needs to be debated and if, by analysis, it is shown to provide advance warning of a runway incursion, it should be included in the MASPS and MOPS.

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5	Livack (7)	1.3.6 Other Applications 2.2.5.1.11 Aircraft ID Data	11 124	General aviation issue. The function / process to achieve GA ADS-B anonymity protection when using the 1090 data link appears not to have been addressed. For example, in the UAT implementation in Alaska, by modifying the ICAO 24 bit code, the UAT implementation effectively moots the ability to use the assigned 24 bit ICAO registry data in conjunction with a look-up table to identify aircraft by Make / Model. A similar 1090 MOPS anonymity function needs to be specifically included in this current version of the MOPS. However, any CDTI or controller's display must maintain its ability to display aircraft make / model silhouettes but without the ID data tag. **WG#3 Position:** *Need a uniform statement on the need for this in the MASPS, but if randomness is needed to get full anonymity, WG#3 has a great concern that randomness will cause duplicate addresses to appear within proximity of each other which violates the MASPS. WG#3 does not feel non-unique addresses are good, but if this is the unified RTCA position for broadcast-only devices, WG#3 can technically .add this capability to the non-tranponder implementation of extended squitter.*	This is a policy issue that if not adequately addressed, will adversely affect GA fleetwide equipage. Suggest that this issue be addressed in the MOPS.
6	Livack (10)	1.3.6 Table 2-9A Table 2-72	11 37 171	Safety issue. Fixed and tethered obstacles, while addressed in general terms in the draft 1090 MOPS, are not addressed well. Additionally, there appears to be no apparent means specified to mark (and thus depict) moving vehicles that create obstructions. Moving obstructions include, for example, vehicles operating on or off hard surface roads on airports, trains operating on railroad tracks immediately adjacent to runway thresholds, and vessels operating on navigable waterways, all of which can create a hazard or obstruction especially on or near airports. **WG#3 Position:** *Beyond reasonable scope of any ADS-B system.*	This is a safety critical item. This message set needs to be included in the MOPS.
7	Livack (11)	1.3.6 Table 2-9A Table 2-72	11 37 171	Safety issue. Catenary and other continuous obstacle depictions are not addressed. There are many other types of obstacles that do not fit well as a point-obstacle depiction, such as tall tree-lines, building clusters, dams, and microwave transmission corridors. These types of obstacles require a more complex message description. Towers supporting catenaries should be depicted and a special representation used for catenaries because the catenary itself may be a significant obstruction. In these cases, catenaries need to be depicted as a linear feature with the adjacent support towers depicted at either end. **WG#3 Position:** *Candidate for Nav database rather than an ADS-B system.*	This is a safety critical item. The message set needs to be included in the MOPS.

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8	Livack (14)	1.3.6	11	Non airport surface movement potential (future) application. There appears to be a lack of specificity as to whether (and specifically how) the 1090 data link can support the future air-to-air and / or air-to-ground exchange of FIS-B downlink enabled AUTOMETS for MET reporting. This application is of high interest, with funding for low-cost GA sensors being provided by NASA's AWIN program although, as of this time, their concept is data link independent. (The ADS-B AUTOMET concept uses ADS-B as the means to exchange aircraft ID and position reporting and MET data, thereby saving overall bandwidth and equipage costs, especially for the GA owner). Several ADS-B MET-related messages set elements will need to be exchanged. These data sets are defined in some detail in DO-252. The AUTOMET application is also described in DO-252. See also Appendix E of DO-242. **WG#3 Position:** *Items #8 and 9 WG#3 doubts the maturity of these future applications is such to warrant consideration into DO-242A.*	There needs to be provision to support this future application.
9	Livack (15)	1.3.6	11	Another potential (future) application, but as yet not validated. There appears to be a lack of specificity as to how the 1090 data link can be used to support the air-to-air (and air-to-ground) exchange of a LIMITED sub-set of the above FIS-B AUTOMET parameters for use in ADS-B wake vortex modeling. In this application, ADS-B would be used to exchange aircraft ID, aircraft position information, and certain wake vortex modeling parameters. It is believed that this wake vortex modeling concept could help enhance Safe Flight 21 Application # 3.2 approach spacing and SF 21 Application # 3.4, departure spacing / clearance tool, by allowing for safe (but reduced) in-trail separation on arrival and departure. Several data set elements have been identified but not yet flight validated as part of an integrated ADS-B wake vortex modeling application. Contact Wendy Holforty, a graduate student at Stanford University, for specifics. Flight evaluations are planned for this Summer. **WG#3 Position:** *Items #8 and 9 WG#3 doubts the maturity of these future applications is such to warrant consideration into DO-242A.*	There needs to be provision to support this future application if it proves feasible.

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10	James Maynard (22)	2.2.3.2.3.1.2	42	Selecting the type code based on accuracy information (HFOM) in the absence of integrity information (HPL) is bogus. The type code carries integrity information (NUC_P, which should later be renamed NIC for Navigation Integrity Level). HPL is an integrity bound, but HFOM is only an accuracy bound. **WG#3 Position:** *Items #10, 11, and 12: Will accommodate these items if NIC/NAC is incorporated into DO-242A. However, WG#3 has seen great difficulty in getting this information (especially NUCR), and cautions that to now require this data in a more specific manner will not be easy. WG#3 would like to see writeups on exactly how this information is to be derived.*	a. Leave the text as it stands for the initial version of this MOPS. b. Address this as a recommended change to the DO-242 MASPS and to "Rev A" of this MOPS.
11	James Maynard (34)	2.2.3.2.4.1.2	56	Same comment as James Maynard (22) above, but for the type code in the Surface Position Message. **WG#3 Position:** ***See item 19 above.***	Same proposed resolution as for James Maynard (22) comment.
12	James Maynard (37)	2.2.3.2.4.1.4.c	57	Same comment as James Maynard (22) above, but for the Surface Position Message. **WG#3 Position:** ***See item 19 above.***	Same proposed resolution as for James Maynard (22) comment.
13	C.Moody (4)	2.2.3.2.6.1.2	71	Subtypes 1 and 2 use N/S E/W (velocity over ground) and Subtypes 3 and 4 use Magnetic Heading and Airspeed. The subtypes that include magnetic heading and airspeed are to be used only when velocity over the ground is "not available" according to Table 2-17. Is the "not available" meant in a *failure* or *installation doesn't support* context? If it is for failure of velocity over ground, wouldn't that likely include failure of position as well? And if that's the case, is subtype 3 and 4 really worth the trouble given it is reported mutually exclusive with velocity over ground? If it is worth it, is it required that every installation support a magnetic heading and ground speed input? **WG#3 Position:** *It is possible to have a simpler navigator which would use subtypes 3 & 4 due to "not available" conditions and not just "failure" conditions. This would mean that subtypes 3 & 4 are required by 1090 MHz ADS-B to stay in compliance with DO-242A.* *Also, WG#3 feels the MASPS should be revised so that it is NOT required to provided both ground and air referenced data at the same time.*	Forget velocity subtypes 3 and 4. They are more trouble than they are worth.
14	C.Moody (7)	2.2.3.2.7.1.3	91	Are all these various trajectory types required by the MASPS? Doesn't the MASPS assume a straight geodesic course to all TCPs? **WG#3 Position:** *Non-issue. WG#3 admittedly went beyond the MASPS requirements.*	Include a NOTE that explains why this capability beyond the MASPS is included.

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15	Hilb (5)	2.2.3.2.7.1.4	92	The use of TCP Data Valid Subfield is not well explained. **Temporary resolution:** Changed 2.2.3.2.7.1.4 to show zero (0) as the only acceptable coding value for initial 1090 MOPS publication. Changed 2.4.3.2.7.1.4, Step 1 to test for condition zero (0) only. **WG#3 Position:** *WG#3 agrees this issue needs addressed in DO-242A.*	Add **Note:** *The TCP Valid Subfield is used to indicate that the aircraft is flying to the broadcast TCP and will arrive at the time projected. This indication is intended primarily for newaircraft and manufacturers will design automation systems to insure a TBD level of compliance to a TCP before indicating the information is valid.*
16	Hilb (2)	2.2.3.2.7.2	94	TCAS RA status is needed for CD&R application **WG#3 Position:** *Before finalizing position, WG#3 will discuss further with Bob Hilb as to why he wants coordination data rather than just own A/C's RA data. (Easier for transponder to access??)*	Add new section 2.2.3.2.7.2.8A ME bit 48-49, Message bit 80-81 **"TCAS RA" Subfield in Aircraft Operational Coordination Msg** Add table 2-52A Coding Meaning 00 No "TCAS RA" Info available 01 TCAS is not issuing an RA 10 TCAS is issuing a don't climb xlink 11 TCAS is issuing a don't descend xlink Change the following as appropriate: Figure 2-9, Sections 2.2.3.2.7.2.9, 2.2.8.2.1, 2.2.8.2.14, 2.2.5.1.33A, 2.4.3.2.7.2.9, A.4.10
17	Hilb (6)	2.2.3.2.7.3.3.1	98	Table 2-54 – Many of the initial applications depend on the controller and other flight crew knowing if an A/C has an operational CDTI. The CD&R application needs to know if the other A/C has an operational TCAS. **Temporary resolution:** Changed Table 2-54, initially as suggested by Hilb, but further discussion by Jerry Anderson, Vince Orlando and others during the CPR correction phase after Plenary led to a revision of the meanings as published in the initial 1090 MOPS. **WG#3 Position:** *WG#3 agrees this issue needs addressed in DO-242A. Also, WG#3 has revised the table that is in the published MOPS. To read as follows:* Bit 9, 10, 11, 12 Meaning 0000 TCAS Not Operational, CDTI Not Operational or unknown 0001 TCAS Not Operational, CDTI Operational 0010 TCAS Operational, CDTI Not Operational or unknown 0011 TCAS Operational, CDTI Operational	Change Table 2-54 as follows: Bit 9, 10, 11, 12 Meaning 0000 TCAS and CDTI Operational 0001 TCAS Operational, CDTI not 0010 CDTI Operational, TCAS not 0011 Neither CDTI nor TCAS Operational Change the following as appropriate: 2.4.3.2.7.3.3.1, A.4.11.3, Table A-13

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18	Rick Cassell (1)	2.2.3.3.2.3	106	Changing the broadcast rate from a nominal 0.5 seconds to 5.0 seconds when the target is stopped will cause a 5 second delay in alerting on runway incursions. This occurs when an aircraft crosses a hold line from a stop. This is unacceptable from a safety standpoint. **Temporary resolution:** Added a new Note after 2.2.3.3.2.3.c indicating that further analysis is necessary and it was believed that the rate would be raised to once per second. **WG#3 Position:** *WG#3 feels that changing the 10m criteria for detecting movement to 3 m would be a better solution than changing the low-rate from 5 seconds to 1 second. With most airports that would have a runway incursion system also having LAAS the 3 m precision should be attainable. This would prevent us from having to change DO-181 also and therefore be a cleaner solution. If this solution is acceptable, there is not an issue here for DO-242A.*	Several options are acceptable. 1. Keep the broadcast rate constant, independent of the vehicle movement. 2. Change the "Low" rate to a nominal 1.0 second broadcast rate. This is an acceptable rate for surface targets. 3. Change the criteria for transitioning between rates from position to velocity. A recommended criteria could be 1.0 m/s. Note that in Table 2-13, the criteria for defining the aircraft as being stopped is <0.125 knots.
19	Rick Cassell (2)	2.2.5.1.7	121	The ADS-B MASPS indicated that for surface movement requirements, that the [own position latitude] reports are assumed to be given with respect to a "certified navigation center" of the aircraft (DO-242, Section J.3.2.2). This is necessary to ensure meeting the overall accuracy requirements for surface surveillance. The 1090 MOPS fails to specify anything about the reference point for the position information. **Temporary resolution:** Added a new Note after 2.2.5.1.7.c indicating that any application that uses ADS-B surface position information will have to take into account the offset of the information to the navigation reference point. **WG#3 Position:** *Items #19 & 20: WG#3 feels this information would be extremely difficult to include from an installation/airframe standpoint. WG#3 feels that the current buffer for transmitting of antenna is adequate.*	Add language to specify that the encoded latitude is referenced to a nevigation reference point. The recommended options are: 1. The center of the aircraft 2. The nose of the aircraft Note that there should be an associated test specified for this requirement. This should probably be included in Section 3.
20	Rick Cassell (3)	2.2.5.1.8	122	The ADS-B MASPS indicated that for surface movement requirements, that the [own position longitude] reports are assumed to be given with respect to a "certified navigation center" of the aircraft (DO-242, Section J.3.2.2). This is necessary to ensure meeting the overall accuracy requirements for surface surveillance. The 1090 MOPS fails to specify anything about the reference point for the position information. **Temporary resolution:** Added a new Note after 2.2.5.1.8.c indicating that any application that uses ADS-B surface position information will have to take into account the offset of the information to the navigation reference point. **WG#3 Position:** ***See item 19 above.***	Add language to specify that the encoded latitude is referenced to a navigation reference point. The recommended options are: 3. The center of the aircraft 4. The nose of the aircraft Note that there should be an associated test specified for this requirement. This should probably be included in Section 3.

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21	C.Moody (5)	2.2.5.1.19	128	This paragraph describes the encoding of the Velocity Subtype. The implication is that the subtype information is handed to the ADS-B system from an external input. Instead should not the ADS-B installation have to determine the subtype appropriate for a given condition? **Temporary resolution:** This section was initially entitled "Subtype (Velocity) Data" and dealt with the 'transmitting device accepting own vehicle Subtype information via an appropriate variable data input interface.' This section was deleted as a result of discussions and the section relabeled "Unused." **WG#3 Position:** *Items 21 & 22: No longer an issuesince related text was deleted.*	Problem fixed if recommendation for Item C.Moody (4) is adopted.
22	C.Moody (6)	2.4.3.2.6.1.2	343	This paragraph describes verification of subtype field in the velocity message. Step 3 of this procedure implies that all one need to do to get a subtype 3 to happen is to "provide velocity information in the form of airspeed and heading…". But from Table 2-17 it would seem it would also require the UNavailability of velocity over ground **WG#3 Position:** *Items 21 & 22: No longer an issuesince related text was deleted.*	Problem fixed if recommendation for Item C.Moody (4) is adopted.
23	C.Moody (16)	3.1	629	Should any Class of equipment be allowed to use a VFR GPS system? Every ADS-B installation will likely support conflict avoidance and some ground based ATC services. We really don't make a VFR/IFR distinction for transponders; should we for the data source requirements for A0/A1/B1? **WG#3 Position:** *WG#3 agrees this issue needs addressed in DO-242A.*	Have consistent minimum information source requirements for A0/A1/B1.
24	Livack (18)	Appendix D		Architecture question. Might the 1090 ADS-B MOPS implementation be able to broadcast a carrier-only message set when there was a loss in nav function? Might multiple TIS-B ground sites be able to process this information, then uplink "own ship" track files, so as to provide some level of back-up secondary navigation capability? Some say that RNP 1 is possible with this very "crude" back-up navigation system. If technically feasible, this functionality needs to be specifically included in the draft 1090 MOPS. **WG#3 Position:** ***WG#3 does not find these items to be at a high enough maturity level to be incorporated into DO-260A.***	Discuss with WG-2. If feasible, include as a re-write in Appendix D.

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25	Livack (17)	Appendix F, R2.29		Add souls on board (SOB) and fuel on board (FOB) and broadcast this information in the event of an emergency. This data is needed for enhanced CFR response. **WG#3 Position:** *WG#3 does not see how this data items could feasably be included and updated in an accurate manner.*	MASPS / MOPS issue